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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,027	12/28/2001	Xiangyang Zhuang	CR00311M(72463)	9194

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FITCH EVEN TABIN AND FLANNERY
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EXAMINER	
HO, CHUONG T	

ART UNIT	PAPER NUMBER
2619	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/035,027	ZHUANG ET AL.	
	Examiner	Art Unit	
	CHUONG T. HO	2619	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 March 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,11,19,22,23,28 and 29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *19,22,23,28,29* is/are allowed.

6)☒ Claim(s) *1-8 and 11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

1. The Amendment filed 03/14/08 have been entered and made of record.

2. Applicant's arguments with respect to claims 1-8, 11, 19, 22, 23, 28, 29 have been considered but are moot in view of the new ground(s) of rejection.

3. Claims 1-8, 11, 19, 22, 23, 28, 29 are pending.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims, 1-2, 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ling et al. (U.S.Patent No. 6,961,388) in view of Vila et al. (U.S.Patent No. 6,757,348).

In the claim 1, Ling et al. discloses providing a datastream comprised of bits (see figure 2A, col. 6, lines 38-52, encoder 202 receives and encodes the information bits in accordance with a particular encoding scheme to provide coded bits); comprising:

- Interleaving (see figure 7, col. 18, lines 10-15, Encoder/Channel Interleaver/Puncture Symbol Mapping 712a...712k) the bits of the datastream across a plurality of orthogonal frequency division multiplexing radio frequency transmitters (modulator 122a.... modulator 122t) (see fig. 7 col. 18, lines 55 - 56, The techniques described herein are applicable for multiple parallel transmission channels supported by MIMO, OFDM, or any other communication scheme (e.g., a CDMA scheme) capable of

supporting multiple parallel transmission channels), wherein each of the radio frequency transmitters (fig. 7, 122a, 122T) transmits a plurality of radio frequency subcarriers to provide interleaved bits with low channel response correlation (col. 19, lines 33-35, correlation) to thereby exploit an increase amount of spatial and frequency diversity (col. 6, line 43, spatial diversity) (col. 6, line 60-62, frequency diversity) (col. 18, lines 10-15, Each channel data stream is provided to a respective encoder/channel interleaver/puncturer/symbol mapping element 712 that encodes the data using a particular encoding scheme selected for that channel data stream, interleaves the encoded data based on a particular interleaving scheme, punctures the interleaved code bits, and maps the interleaved data into modulation symbols for the one or more transmission channels used for transmitting that channel data stream.);

- Transmitting data that corresponds to the interleaved bits using the plurality of radio frequency subscarriers of the plurality of orthogonal frequency division multiplexed radio frequency transmitters (122a..122t) (see col. 7, lines 63-66, each modulator 122 converts the modulation symbols into an analog signal, and further amplifies, filters, quadrature modulates, and upconverts the signal to generate a modulated signal suitable for transmission over the wireless link).

However, Ling is silent to disclosing wherein adjacent bits are assigned to different transmitters and different subcarriers.

Vila et al. discloses wherein adjacent bits (col. 4, lines 27-28, data symbols is use here in a generic sense and my comprise bits) (figure 3, data symbols 0, 1, 2, 3, 4, 5, 6, 7 are assigned communication links 34a, 34b, 34c, 34d, col. 4, lines 34-35, lines 8-13, lines 38-45) (col. 4, lines 26-27, datastream includes 32 data symbols) are assigned to different transmitters (figure 3, communication links 34a, 34b, 34c, 34d) and different subcarriers (see abstract, transmission lanes).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate wherein adjacent bits are assigned to different transmitters and different subcarriers taught by Vila into the system of Ling. One would have been motivated to do so to multiplex from a single serial stream to a serial stream for each of the lane.

Regarding to claim 2, Ling discloses wherein providing a datagram comprised of bits includes providing a datagram comprised of bits as provided from single source (figure 1, data source 112) (col. 18, lines 10-15, Each channel data stream is provided to a respective encoder/channel interleaver/puncturer/symbol mapping element 712 that encodes the data using a particular encoding scheme selected for that channel data stream, interleaves the encoded data based on a particular interleaving scheme, punctures the interleaved code bits, and maps the interleaved data into modulation symbols for the one or more transmission channels used for transmitting that channel data stream).

Regarding to claim 11, Ling discloses wherein assigning datastream bits to differing transmitters and differing subcarriers with low channel response correlation further comprising assigning datastream bits out of each encoder when multiple encoders are used to differing transmitters and different subcarriers with low channel respone correlation to thereby exploit an increased amount of spatial and frequency diversity for each encoded datastream (col. 19, lines 33-35, correlation) (col. 6, line 43, spatial diversity) (col. 6, line 60-62, frequency diversity) (col. 18, lines 10-15, Each channel data stream is provided to a respective encoder/channel interleaver/puncturer/symbol mapping element 712 that encodes the data using a particular encoding scheme selected for that channel data stream, interleaves the encoded data based on a particular interleaving scheme, punctures the interleaved code bits, and maps the interleaved data into modulation symbols for the one or more transmission channels used for transmitting that channel data stream.);

However, Ling is silent to disclosing wherein adjacent bits are assigned to different transmitters and different subcarriers.

Vila et al. discloses wherein adjacent bits (col. 4, lines 27-28, data symbols is use here in a generic sense and my comprise bits) (figure 3, data symbols 0, 1, 2, 3, 4, 5, 6, 7 are assigned communication links 34a, 34b, 34c, 34d, col. 4, lines 34-35, lines 8-13, lines 38-45) (col. 4, lines 26-27, datastream includes 32 data symbols) are assigned to different transmitters (figure 3, communication links 34a, 34b, 34c, 34d) and different subcarriers (see abstract, transmission lanes).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate wherein adjacent bits are assigned to different transmitters and different subcarriers taught by Vila into the system of Ling. One would have been motivated to do so to multiplex from a single serial stream to a serial stream for each of the lane.

5. Claims 3-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combined system (Ling - Vila) in view of Sarraf et al. (U.S.Patent No. 6,747,948 B1).

In the claim 3, the combined system (Ling - Vila) discloses the limitations of claim 1 above.

However, the combined system (Ling - Vila) are silent to disclosing providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a plurality of sources.

Sarraf et al. , see figure 2, discloses the signal generation unit modulates a plurality of subcarriers, which may be OFDM sub-carriers, based on the interleaved substream and upconverts the modulated subcarriers for transmission (see col. 2, lines 32-35); comprising:

- providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources).

Both Ling, Vila and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Sarraf recognizes providing datastream comprised of bits includes

providing a datastream comprised of bits as provided from a plurality of sources. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combined system (Ling - Vila) with the teaching of Sarraf to provide providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a plurality of sources in order to improve the performance of error correction decoders.

Regarding to the claim 4, the combined system (Ling - Vila) discloses the limitations of claim 3 above.

However, the combined system (Ling - Vila) are silent to disclosing providing a datastream comprised of bits as provided from a plurality of sources includes providing a datastream comprised of bits as provided from a plurality of sources wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits.

Sarraf et al. discloses providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources) includes providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources) wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits (encoding unit 16, see figure 2) (see col. 3, lines 27-55).

Both Ling, Vila and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Sarraf recognizesproviding a datastream comprised of bits as provided from a plurality of sources includes providing a datastream comprised of bits as provided from a plurality of sources wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combined system (Ling - Vila) with the teaching of Sarraf to provide providing a datastream comprised of bits as provided from a plurality of sources includes providing a datastream comprised of bits as provided from a plurality of sources wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits in order to improve the performance of error correction decoders.

In the claim 5, the combined system (Ling - Vila) discloses the limitations of claim 3 above.

However, the combined system (Ling - Vila) are silent to disclosing providing a datastream comprised of bits includes providing a datastream comprised of encoded bits.

Sarraf et al. discloses providing a datastream comprised of bits includes providing a datastream comprised of encoded bits (encoded data, see abstract) (see col. 3, lines 27-55).

Both Ling, Vila and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Sarraf recognizes providing a datastream comprised of bits

includes providing a datastream comprised of encoded bits. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combined system (Ling - Vila) with the teaching of Sarraf to provide providing a datastream comprised of bits includes providing a datastream comprised of encoded bits in order to improve the performance of error correction decoders.

Regarding to the claims 6, the combined system (Ling - Vila) discloses the limitations of claim 3 above.

However, the combined system (Ling - Vila) are silent to disclosing a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits.

Sarraf et al. discloses a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits (see col. 3, lines 27-55).

Both Ling, Vila and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Sarraf recognizes providing a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combined system (Ling - Vila) with the teaching of Sarraf to provide a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits in order to improve the performance of error correction decoders.

Regarding to the claim 7, the combined system (Ling - Vila) discloses the limitations of claim 3 above.

However, the combined system (Ling - Vila) are silent to disclosing providing a datastream comprised of encoded bits includes providing a datastream comprised of serially concatenated convolutionally encoded bits.

Sarraf et al. discloses providing a datastream comprised of encoded bits includes providing a datastream comprised of serially concatenated convolutionally encoded bits (see col. 3, lines 27-55).

Both Ling, Vila and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Sarraf recognizes providing a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combined system (Ling - Vila) with the teaching of Sarraf to provide a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits in order to improve the performance of error correction decoders.

Regarding to the claim 8, the combined system (Ling - Vila) discloses the limitations of claim 3 above.

However, the combined system (Ling - Vila) are silent to disclosing providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel.

Sarraf et al. discloses providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel (see col. 3, line 21) concatenated convolutionally encoded bits (see col. 3, lines 27-55).

Both Ling, Vila and Sarraf discloses an orthogonal frequency division multiplexing (OFDM). Sarraf recognizes providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combined system (Ling - Vila) with the teaching of Sarraf to provide providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel in order to improve the performance of error correction decoders.

Allowable Subject Matter

6. Claims 19, 22, 23, 28-29 are allowed.

7. The following is an examiner's statement of reasons for allowance: Claim 19 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 28: "wherein demodulation include the use of a zero forcing symbol metric estimator based on ('ln" stands for the natural logarithm) ln P (...) where S is the estimated symbol at the Kth subcarrier of the Jth transmitted antenna, i.e. [..] = w, yk with filter matrix Wk being the zero forcing matrix computed based on the channel

matrix Hk and where Wk (:j) denoted the jth column of Wk "II.II" denotes the vector nome, O is the noise power, and S is any of the constellation symbols ".

8. The following is an examiner's statement of reasons for allowance: Claim 22 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 29: "wherein demodulation include the use of a minimum mean squared error symbol metric estimate based on ("In" stands for the natural logarithm....is the average symbol power, and S is any of the constellation symbols".

9. The following is an examiner's statement of reasons for allowance: Claim 23 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 19: "demodulating the received multi-antenna transmission signals to data bits from bit metrics computed by using a maximum likelihood bit soft information estimator represented by

P (Y (k) | B (I, k)) = Sum seSi (P (Y(k) | S (k) = S) P (S (k) = S)

Where P (Y (k) | B (I, k)) is a probability of observing received signals Y (k) at the Kth subscarriers on at least one antenna under the condition of transmitting bit B (I,k) (0 or 1), and S (i) a set of all symbol vectors whose bit representations contain the given value of the bit of interest B (I, k).

10. The following is an examiner's statement of reasons for allowance: Claim 28 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from

independent claim 22: "demodulating the received multi-antenna transmission signals to recover data bits from bit metrics computed by using a zero forcing bit metric estimator represented by

P (s (j, k) | B (l, k) = Sum s, e, S (i) = exp | - | S (j, k) – S (o) | (exp 2) / (2 || W (k) (:, j) ||

.....and S (i) is a set of constellation symbols whose bit representations contain the given value of the bit of interest B (l, k).

11. The following is an examiner's statement of reasons for allowance: Claim 29 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 23: "demodulating the received multi-antenna transmission signals to recover data bits from bit metrics computed by using a minimum mean squared error bit metric estimator represented by.....and S (i) is a set of constellation symbols whose bit representations contain the given value of the bit of interest b (l, k).

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. El-Gamal; Hesham (7,010,053)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUONG T. HO whose telephone number is (571)272-3133. The examiner can normally be reached on 8:00 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, EDAN ORGAD can be reached on (571) 272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

07/07/08

/Edan Orgad/
Supervisory Patent Examiner, Art Unit 2619